Citizen web-mapping for safer cycling

Dr. Meghan Winters

Dr. Trisalyn Nelson

SFU

SPARlab

frontiers in
PUBLIC HEALTH

TECHNOLOGY REPORT
published: 30 March 2015
doi: 10.3389/fpubh.2015.00053

BikeMaps.org: a global tool for collision and near miss mapping

Trisalyn A. Nelson[1]*, Taylor Denouden[1], Benjamin Jestico[1], Karen Laberee[1] and Meghan Winters[2]

[1] *Spatial Pattern Analysis and Research (SPAR) Laboratory, Department of Geography, University of Victoria, Victoria, BC, Canada*
[2] *Faculty of Health Sciences, Center for Hip Health and Mobility, Vancouver Coastal Health Research Institute, Simon Fraser University, Vancouver, BC, Canada*

Edited by:
Jay E. Maddock, Texas A&M University, USA

Reviewed by:
Katie M. Heinrich, Kansas State University, USA
James Aaron Hipp, Washington University in St. Louis, USA

****Correspondence:***
Trisalyn A. Nelson, Spatial Pattern Analysis and Research (SPAR) Laboratory, Department of Geography, University of Victoria, P.O. Box 3060 STN CSC, Victoria, BC V8W 3R4, Canada
e-mail: trisalyn@uvic.ca

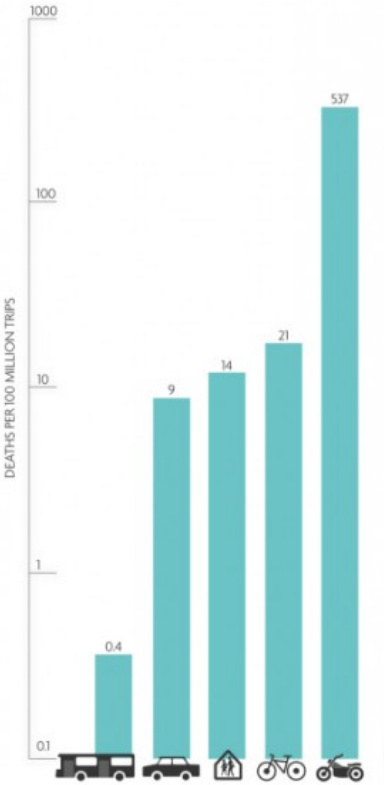
There are many public health benefits to cycling, such as chronic disease reduction and improved air quality. Real and perceived concerns about safety are primary barriers to new ridership. Due to limited forums for official reporting of cycling incidents, lack of comprehensive data is limiting our ability to study cycling safety and conduct surveillance. Our goal is to introduce BikeMaps.org, a new website developed by the authors for crowdsource mapping of cycling collisions and near misses. BikeMaps.org is a global mapping system that allows citizens to map locations of cycling incidents and report on the nature of the event. Attributes collected are designed for spatial modeling research on predictors of safety and risk, and to aid surveillance and planning. Released in October 2014, within 2 months the website had more than 14,000 visitors and mapping in 14 countries. Collisions represent 38% of reports (134/356) and near misses 62% (222/356). In our pilot city, Victoria, Canada, citizens mapped data equivalent to about 1 year of official cycling collision reports within 2 months via BikeMaps.org. Using report completeness as an indicator, early reports indicate that data are of high quality with 50% being fully attributed and another 10% having only one missing attribute. We are advancing this technology, with the development of a mobile App, improved data visualization, real-time altering of hazard reports, and automated open-source tools for data sharing. Researchers and citizens interested in utilizing the BikeMaps.org technology can get involved by encouraging citizen mapping in their region.

Keywords: active transportation, bicycling safety, near miss, citizen science, cycling safety surveillance

5 reasons why

riding a bike is safe

In North America, concerns about safety consistently rank as the top deterrents to bicycling. But does the way we perceive the relative safety of bicycling, driving, motorcycling, transit, and walking make sense? Do our perceptions about these modes of travel match the data? **Learn more at:** *momentummag.com/cycling-is-safe*



1 CYCLING IS NO MORE DANGEROUS THAN DRIVING OR WALKING

Bicycling is similar in safety to driving and walking. If you want to maximize safety alone, then transit is the travel choice you should make.

2 BICYCLE INFRASTRUCTURE AND LOW TRAFFIC STREETS MAKE CYCLING EVEN SAFER

The design of streets greatly influences the overall safety of cycling. The most safe are streets with cycling-specific infrastructure, especially those with protected bike lanes.

3 THE HEALTH BENEFITS FAR OUTWEIGH THE RISKS

Cycling – like walking – has health benefits due to the physical activity involved: reductions in heart disease, diabetes, stroke, dementia, and even certain cancers.

9:1

(some estimate as high as 96:1)

4 CYCLING IS VERY SAFE WHEN COMPARED TO SPORTS TOO

Bicycling is also often compared to sports, but injury numbers, not rates, are reported. A survey from Quebec, Canada found that while bicycling had the 6th most reported injuries, due to it being such a common activity the injury rate was one of the lowest.

THE INJURY RATE was reported in common sports, such as skiing, tennis, basketball, running, baseball, football, soccer, and hockey, compared to cycling.

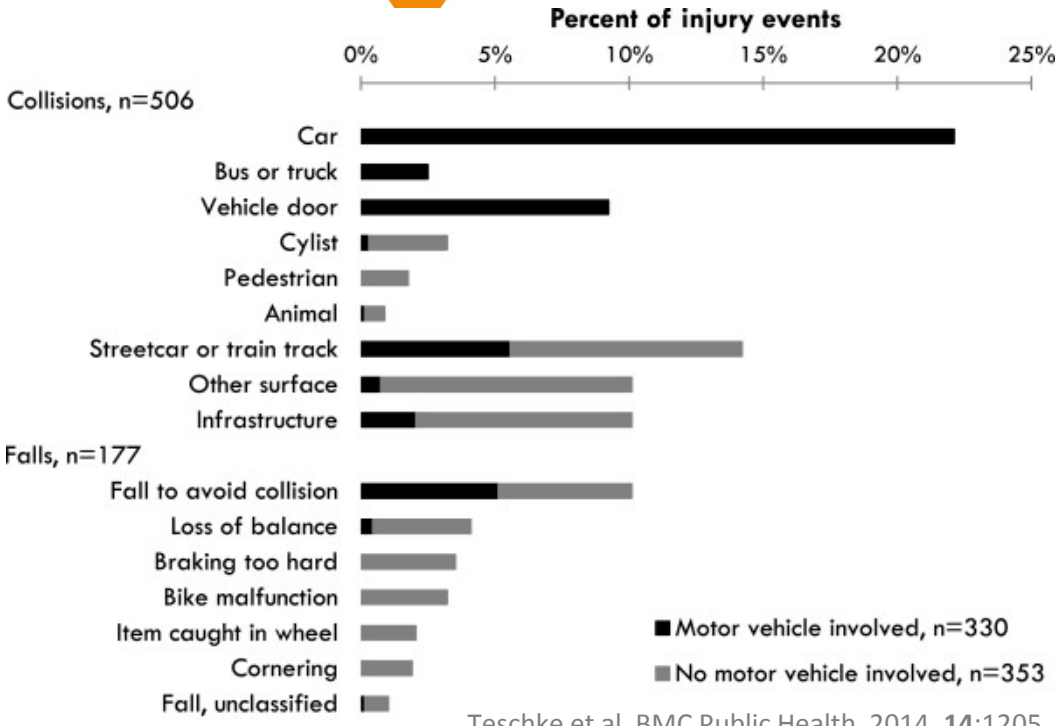
5 PLACES WITH SAFER CYCLING ARE SAFER FOR ALL MODES OF TRAVEL!

Research has shown that cycling is much safer in the Netherlands. Perhaps less well known is that walking and driving are much safer there too. Achieving the same traffic safety level in the US and Canada would save 20,000 lives a year.

Bike Safety Data

- Typically rely on data for **crashes between cyclists and motor vehicles**
- Reported through vehicle insurance claims and/or when police are called to a vehicle crash event

Bike Safety Data



Teschke et al, BMC Public Health, 2014, **14**:1205

In British Columbia, only one motor vehicle insurance company, but:

- Only ~30-40% of serious cycling injuries would be captured by insurance
- No data on off-street injuries
- No data on near misses

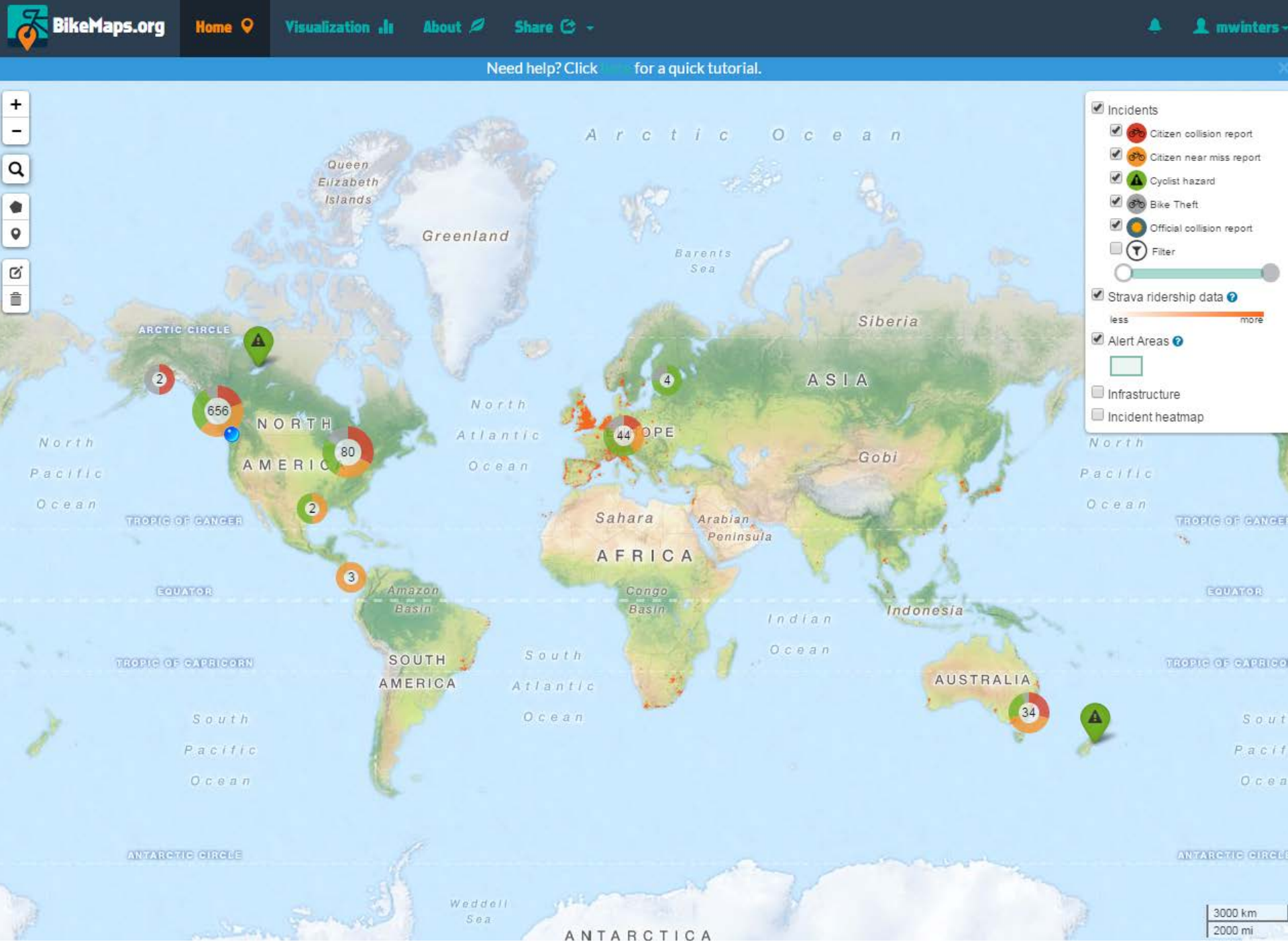
Cyclists Mapping Bike Safety

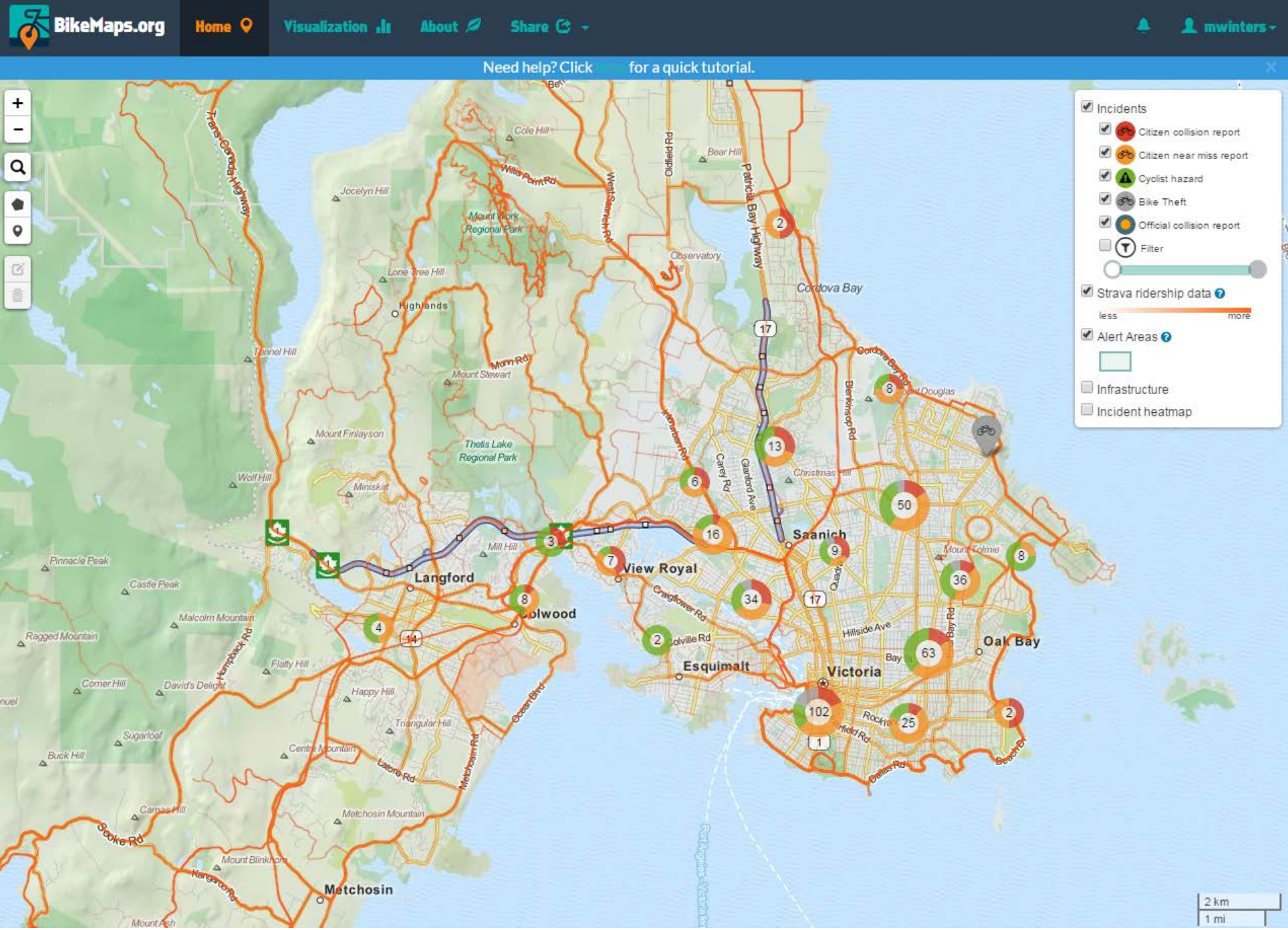
BikeMaps.org

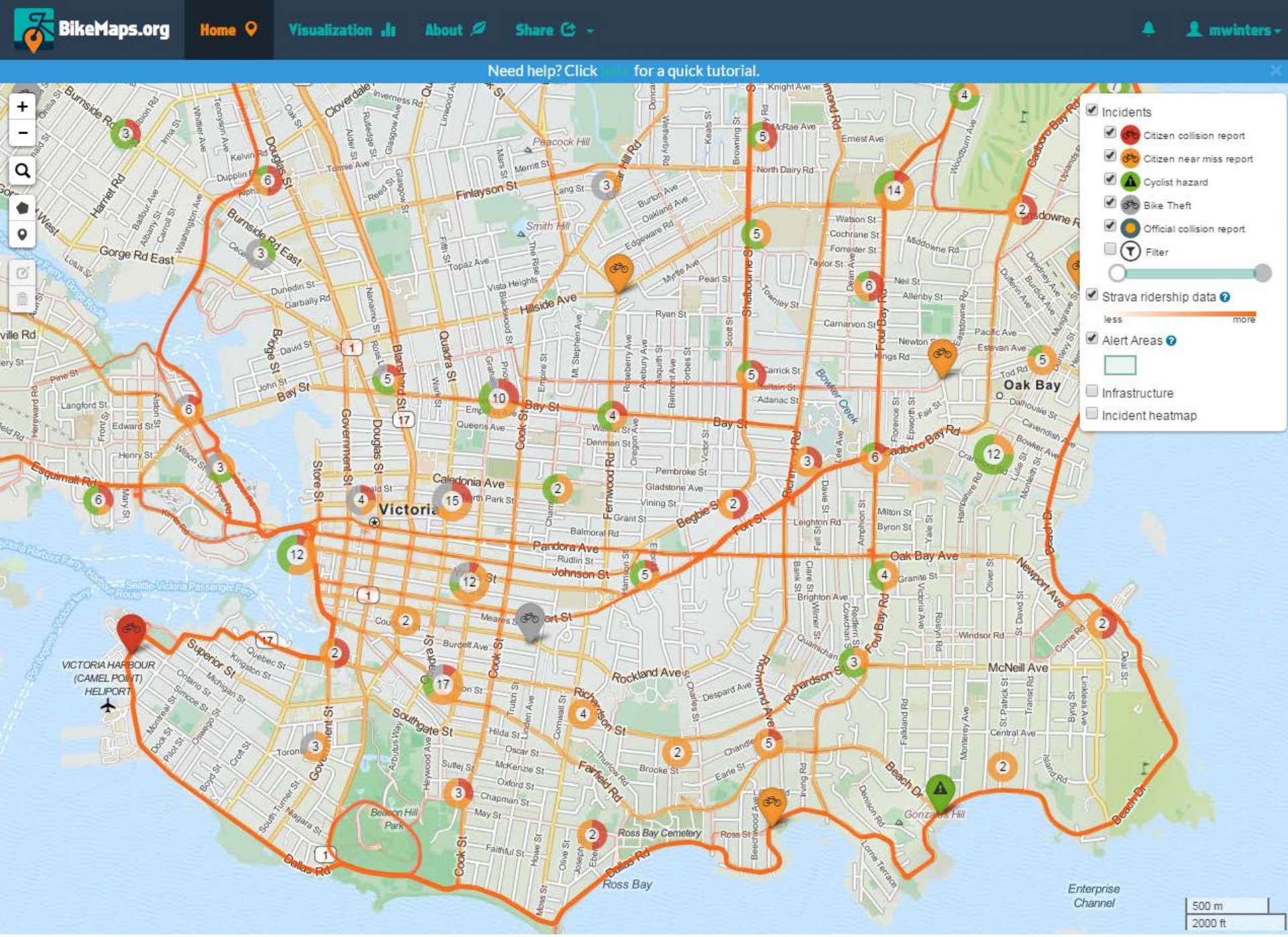
Goal: To develop a web-based tool for citizen mapping of bicycling crashes, near-misses, hazards, and thefts

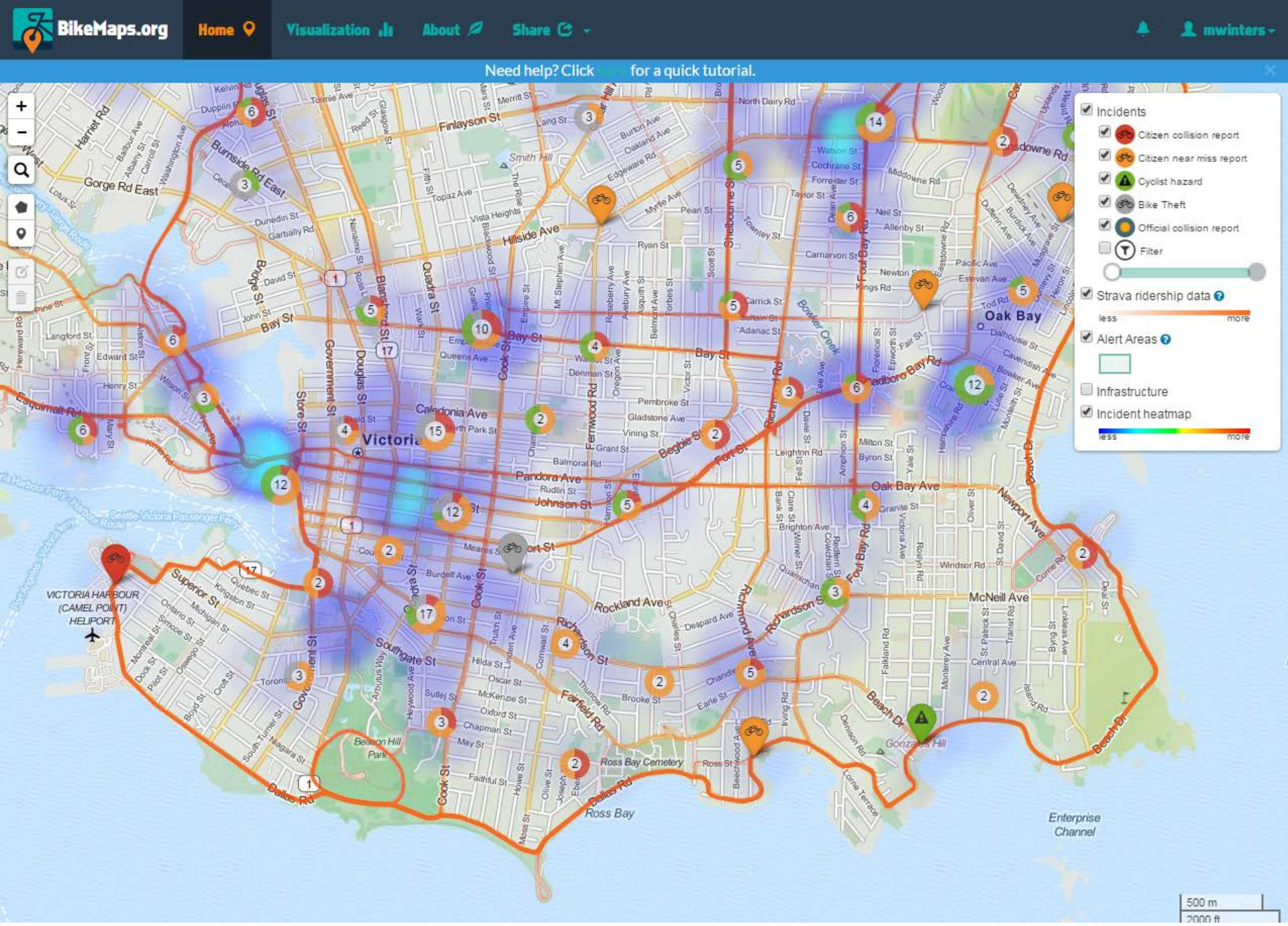
- **Map** your bike crashes, near misses, hazards, and thefts in your area
- Get **safety alerts** for your area
- Plan a **safer route**
- **Be part of building** a more rider-friendly community

Get started at **BikeMaps.org**

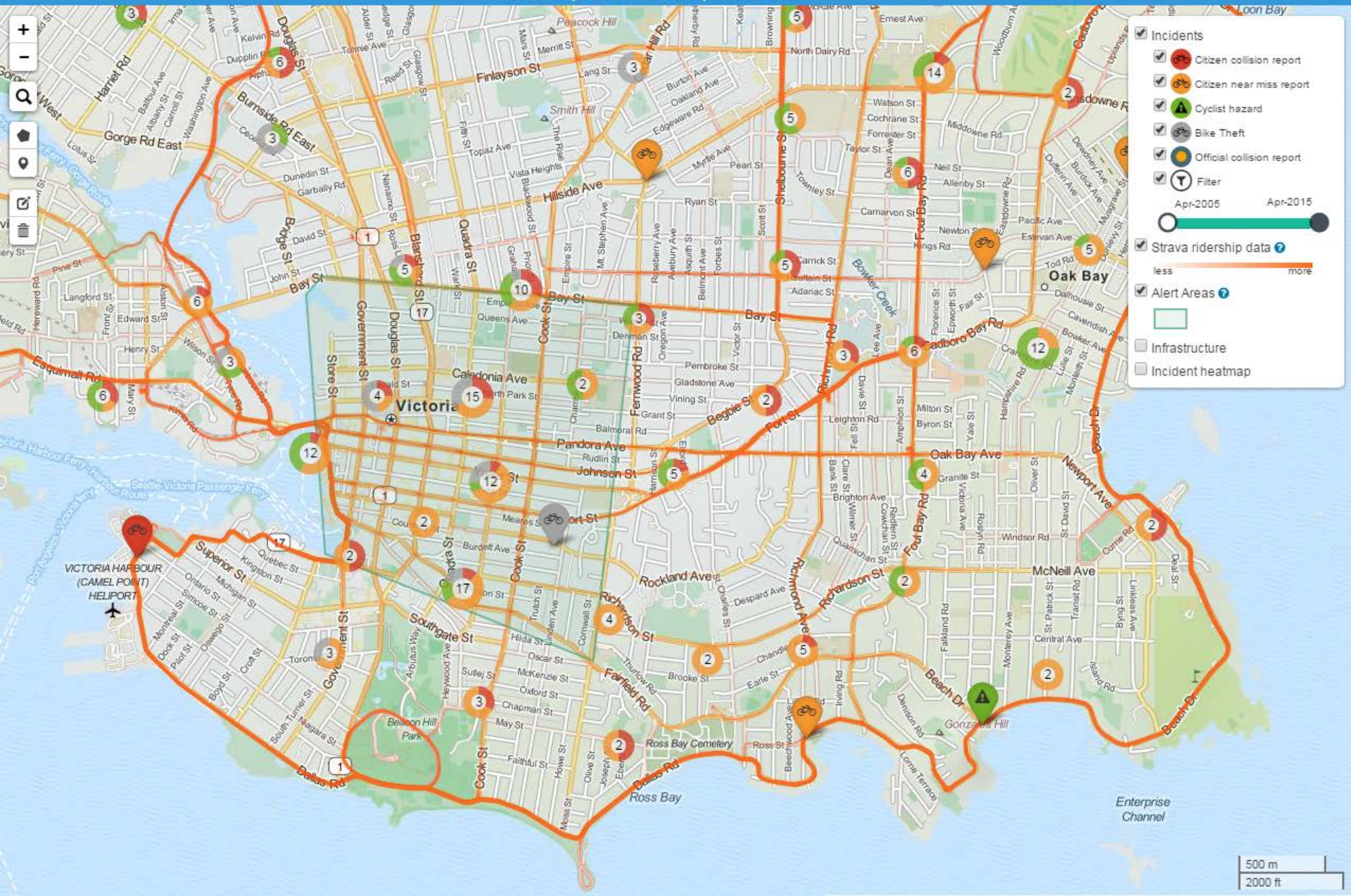

BikeMaps.org
Home
Visualization
About
Share
mwinters
Need help? Click here for a quick tutorial.
Incidents
Citizen collision report
Citizen near miss report
Cyclist hazard
Bike Theft
Official collision report
Filter
Strava ridership data
less
more
Alert Areas
Infrastructure
Incident heatmap
Arctic Ocean
Queen Elizabeth Islands
Greenland
Barents Sea
Siberia
ARCTIC CIRCLE
ASIA
NORTH AMERICA
EUROPE
North Atlantic Ocean
North Pacific Ocean
Gobi
Sahara
Arabian Peninsula
AFRICA
TROPIC OF CANCER
EQUATOR
Amazon Basin
Congo Basin
Indian Ocean
Indonesia
SOUTH AMERICA
South Atlantic Ocean
TROPIC OF CAPRICORN
AUSTRALIA
South Pacific Ocean
ANTARCTIC CIRCLE
Weddell Sea
ANTARCTICA
2
656
80
2
3
4
44
34
3000 km
2000 mi

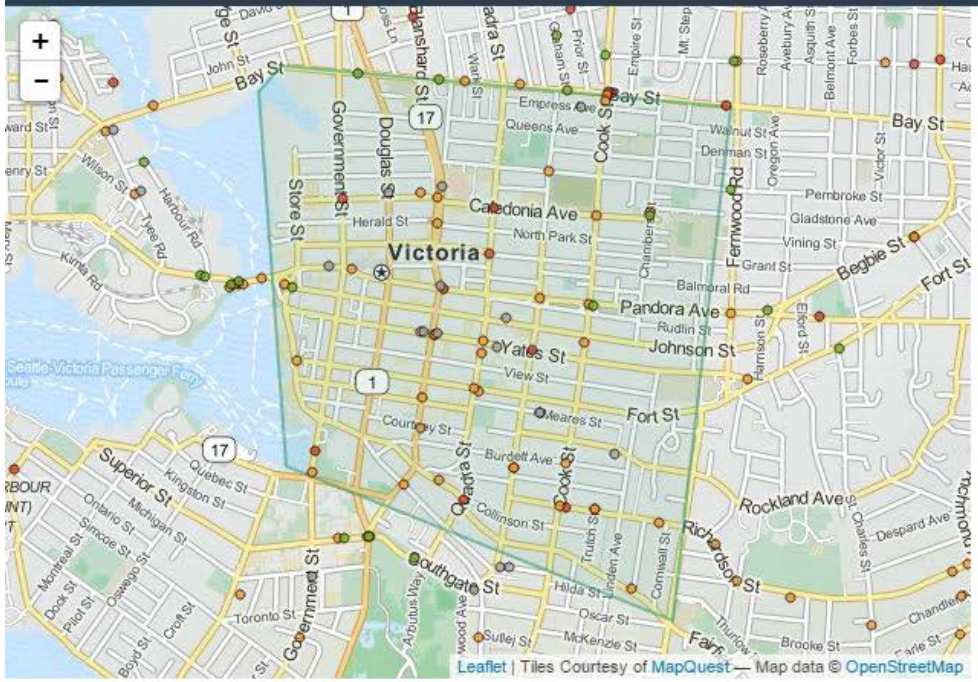

BikeMaps.org
Home
Visualization
About
Share
mwinters
Need help? Click for a quick tutorial.
Incidents
Citizen collision report
Citizen near miss report
Cyclist hazard
Bike Theft
Official collision report
Filter
Strava ridership data
less
more
Alert Areas
Infrastructure
Incident heatmap
Cordova Bay
Saanich
View Royal
Langford
Colwood
Esquimalt
Victoria
Oak Bay
Metchosin
Highlands
Mount Work Regional Park
Thetis Lake Regional Park
Mount Stewart
Mount Finlayson
Mount Tolmie
Mount Douglas
Observatory Hill
Cole Hill
Bear Hill
Jocelyn Hill
Lone Tree Hill
Tunnel Hill
Wolf Hill
Miniskirt
Mill Hill
Christmas Hill
Pinnacle Peak
Castle Peak
Malcolm Mountain
Ragged Mountain
Flatty Hill
Corner Hill
David's Delight
Happy Hill
Triangular Hill
Sugarloaf
Buck Hill
Centre Mountain
Carnas Hill
Metchosin Mountain
Mount Blinkhorn
Mount Ash
Trans-Canada Highway
Willis Point Rd
West Saanich Rd
Oldfield Rd
Patricia Bay Highway
Cordova Bay Rd
Blenkinsop Rd
Interurban Rd
Carey Rd
Glanford Ave
Craigflower Rd
Colville Rd
Hillside Ave
Quadra
Humpback Rd
Ocean Blvd
Latoria Rd
Metchosin Rd
Sooke Rd
Kangaroo Rd
Dallas Rd
Beach Dr
2 km
1 mi

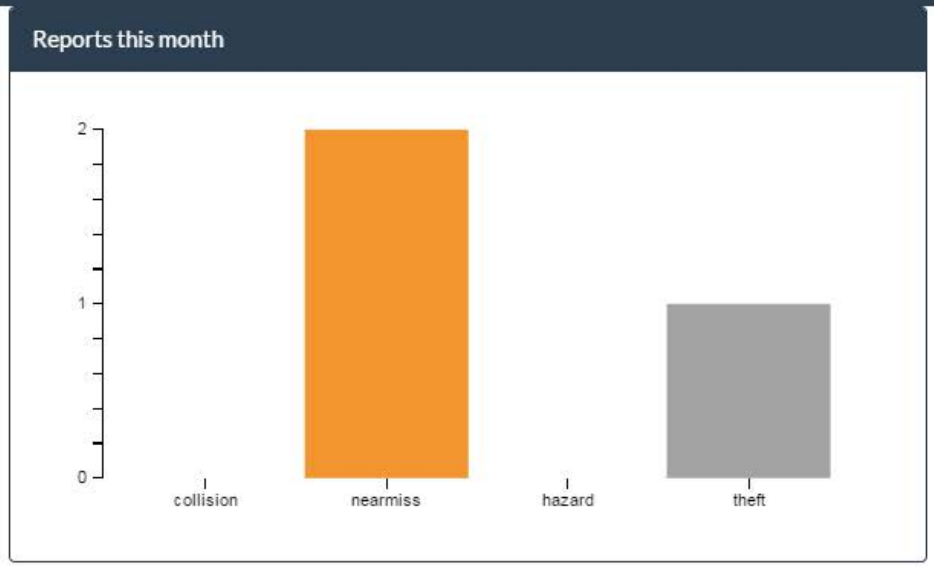

BikeMaps.org
Home
Visualization
About
Share
mwinters
Need help? Click here for a quick tutorial.
Incidents
Citizen collision report
Citizen near miss report
Cyclist hazard
Bike Theft
Official collision report
Filter
Strava ridership data
less
more
Alert Areas
Infrastructure
Incident heatmap
Victoria
Oak Bay
Ross Bay
Enterprise Channel
VICTORIA HARBOUR (CAMEL POINT) HELIPORT
Ross Bay Cemetery
Beacon Hill Park
Gonzales Hill
Peacock Hill
Smith Hill
Finlayson St
Hillside Ave
Bay St
Caledonia Ave
Pandora Ave
Johnson St
Oak Bay Ave
Cadboro Bay Rd
Fort St
Rockland Ave
Richardson St
McNeill Ave
Southgate St
Fairfield Rd
Dallas Rd
Beach Dr
Newport Ave
Foul Bay Rd
Richmond Ave
Cook St
Government St
Douglas St
Blanshard St
Quadra St
Fernwood Rd
Begbie St
Shelbourne St
Burnside Rd East
Gorge Rd East
Harriet Rd
Esquimalt Rd
Superior St
Bowker Creek
500 m
2000 ft

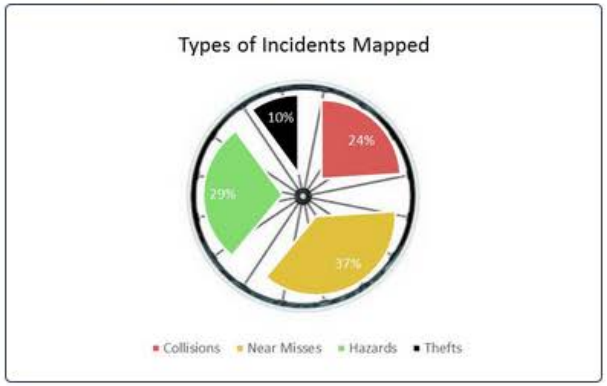

BikeMaps.org
Home
Visualization
About
Share
mwinters
Need help? Click here for a quick tutorial.
Incidents
Citizen collision report
Citizen near miss report
Cyclist hazard
Bike Theft
Official collision report
Filter
Strava ridership data
less
more
Alert Areas
Infrastructure
Incident heatmap
less
more
Victoria
Oak Bay
Finlayson St
Burnside Rd East
Gorge Rd East
Hillside Ave
Bay St
Caledonia Ave
Pandora Ave
Johnson St
Oak Bay Ave
McNeill Ave
Rockland Ave
Richardson St
Southgate St
Fairfield Rd
Dallas Rd
Beach Dr
Newport Ave
Esquimalt Rd
Superior St
Government St
Douglas St
Cook St
Fort St
Foul Bay Rd
Shelbourne St
Richmond Ave
Ross Bay
Ross Bay Cemetery
Beacon Hill Park
Gonzales Hill
Enterprise Channel
VICTORIA HARBOUR (CAMEL POINT) HELIPORT
Seattle-Victoria Passenger Ferry
500 m
2000 ft

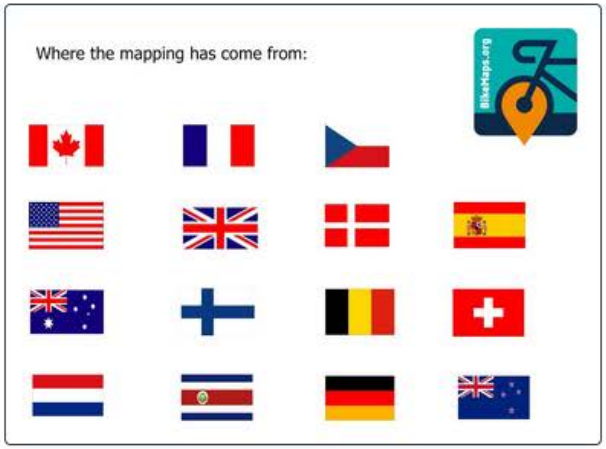
Need help? Click here for a quick tutorial.

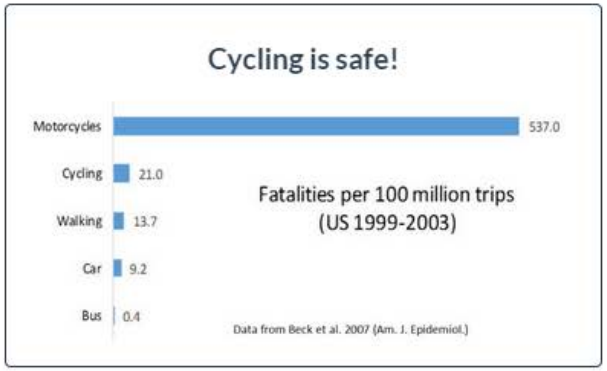



Bay St
Victoria
Caledonia Ave
Pandora Ave
Johnson St
Yates St
Fort St
Rockland Ave
Leaflet | Tiles Courtesy of MapQuest — Map data © OpenStreetMap


Reports this month
2
1
0
collision
nearmiss
hazard
theft

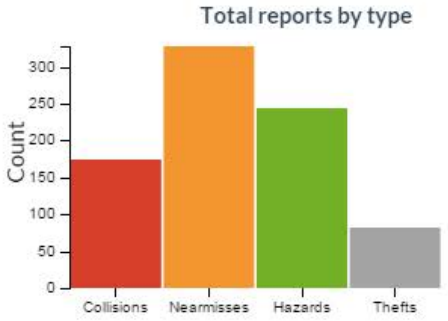

Types of Incidents Mapped
10%
24%
29%
37%
Collisions
Near Misses
Hazards
Thefts

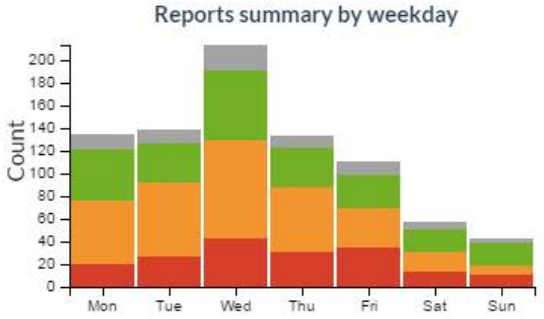

Where the mapping has come from:

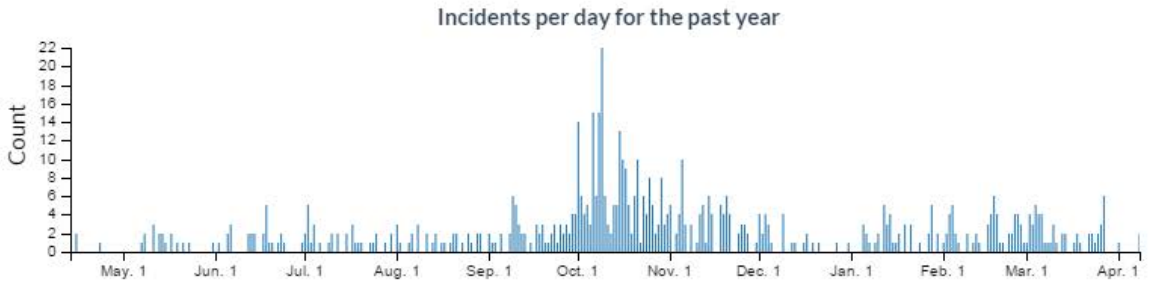

Cycling is safe!
Motorcycles 537.0
Cycling 21.0
Walking 13.7
Car 9.2
Bus 0.4
Fatalities per 100 million trips
(US 1999-2003)
Data from Beck et al. 2007 (Am. J. Epidemiol.)

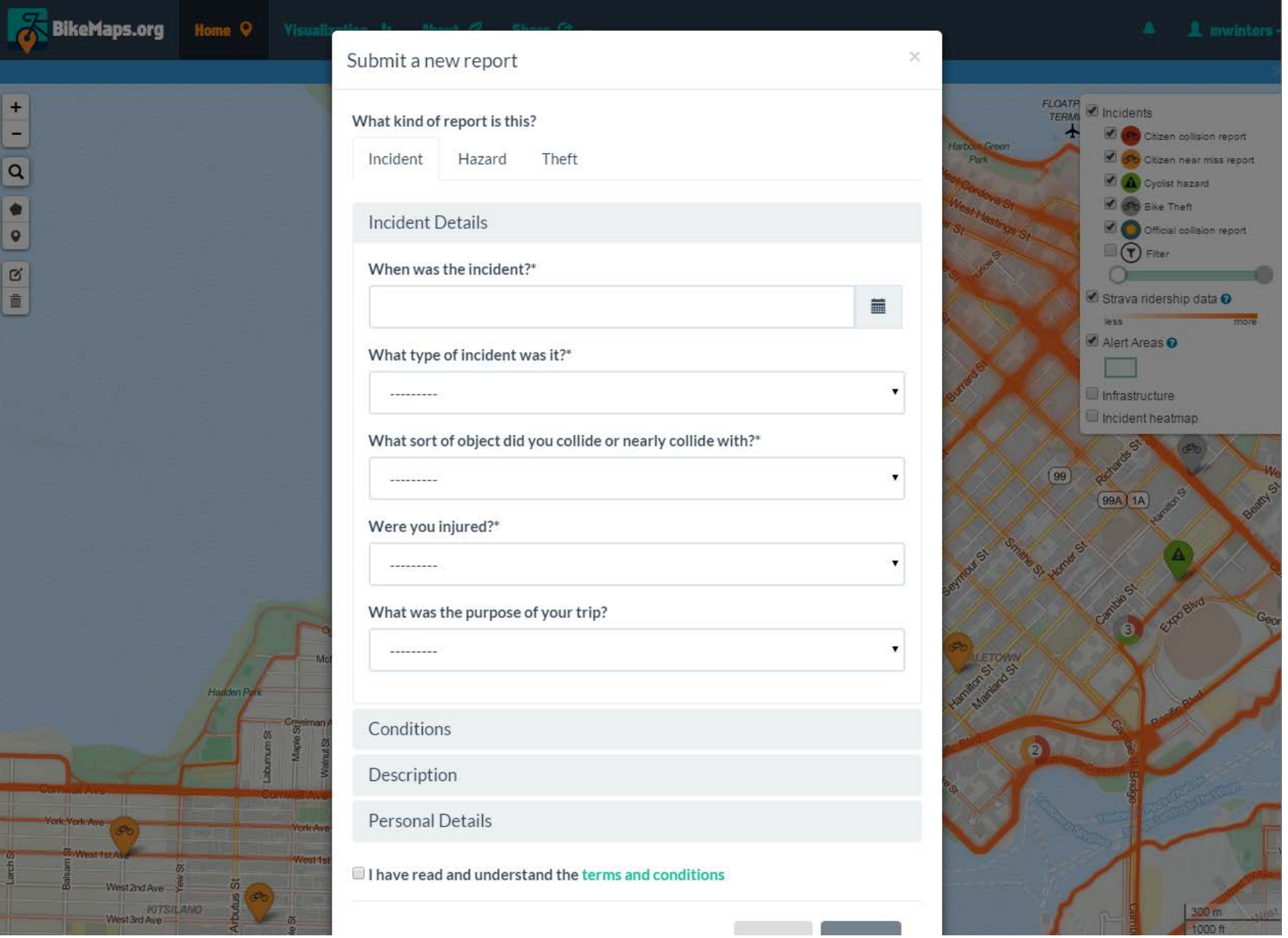
reset all

Halkett Island
Bay Street
Rock Bay
Victoria West
Esquimalt Road
Lime Bay
Pelly Island
Victoria Inner Harbour
James Bay
Superior Street
Victoria
Haultain Corners
Fernwood
Caledonia Street
Pandora Avenue
Johnson Street
Yates Street
Fort Street
Oak Bay Ave
Rockland Avenue
Fairfield Road
Southgate Street
Richardson Street
Cook Street
Quadra Street
Douglas Street
Government Street
Fernwood Road
Begbie Street
Leaflet | © OpenStreetMap contributors, CC-BY-SA


Total reports by type
Count
300
250
200
150
100
50
0
Collisions
Nearmisses
Hazards
Thefts


Reports summary by weekday
Count
200
180
160
140
120
100
80
60
40
20
0
Mon
Tue
Wed
Thu
Fri
Sat
Sun


Incidents per day for the past year
Count
22
20
18
16
14
12
10
8
6
4
2
0
May. 1
Jun. 1
Jul. 1
Aug. 1
Sep. 1
Oct. 1
Nov. 1
Dec. 1
Jan. 1
Feb. 1
Mar. 1
Apr. 1


BikeMaps.org
Home
Visualization
About
Share
mwinters
Submit a new report
What kind of report is this?
Incident
Hazard
Theft
Incident Details
When was the incident?*
What type of incident was it?*

What sort of object did you collide or nearly collide with?*

Were you injured?*

What was the purpose of your trip?

Conditions
Description
Personal Details
I have read and understand the terms and conditions
Incidents
Citizen collision report
Citizen near miss report
Cyclist hazard
Bike Theft
Official collision report
Filter
Strava ridership data
less
more
Alert Areas
Infrastructure
Incident heatmap
Hadden Park
Creelman Ave
Cornwall Ave
York/York Ave
West 1st Ave
West 2nd Ave
West 3rd Ave
KITSILANO
Arbutus St
Maple St
Walnut St
Laburnum St
Larch St
Balsam St
Yew St
Richards St
Burrard St
Seymour St
Smithe St
Homer St
Cambie St
Hamilton St
Mainland St
Expo Blvd
Pacific Blvd
Beatty St
99
99A
1A
2
3
300 m
1000 ft

Crash or near miss details

When was the incident?[a]
- Select date and time

What type of incident was it?[a]
- Collision with stationary object or vehicle
- Collision with moving object or vehicle
- Near collision with stationary object or vehicle
- Near miss with a moving object or vehicle
- Lost control and fell

What sort of object did you collide or nearly collide with?
- Vehicle – head on
- Vehicle – side impact
- Vehicle – angle impact
- Vehicle – rear end
- Vehicle – open vehicle door
- Another cyclist
- Pedestrian
- Animal
- Infrastructure – curb
- Infrastructure – train tracks
- Infrastructure – pothole
- Infrastructure – lane divider
- Infrastructure – sign/post
- Infrastructure – roadway
- Infrastructure – other (please describe)

Were you injured?[a]
- Medical treatment not required
- Saw a family doctor
- Visited the hospital emergency department
- Overnight stay in hospital
- No injury

What was the purpose of your trip?
- To/from work or school
- Exercise or recreation
- Social reason (e.g., movies, visit friends)
- Personal business
- During work
- No response

Conditions

What were the road conditions?
- Dry
- Wet
- Loose sand, gravel, or dirt
- Icy
- Snowy
- I do not remember
- No response

How were the sight lines?
- No obstructions
- View obstructed
- Glare or reflection
- Obstruction on road
- Do not remember
- No response

Were there cars parked on the roadside?
- Yes
- No
- I do not know
- No response

Where were you riding your bike?
- Busy street – on a painted bike lane
- Busy street – on road with no bike facil
- Quiet street – on a painted bike lane
- Quiet street – on road with no bike faci
- On a physically separated bike lane
- On a mixed use trail
- On the sidewalk
- I do not remember
- No response

Were you using bike lights?
- No lights
- Front and back lights
- Front lights only
- Back lights only
- I do not remember

What as the terrain like?
- Uphill
- Downhill
- Flat
- I do not remember
- No response

What direction were you heading?
- N
- NE
- NW
- S
- SE
- SW
- E
- W
- I do not know
- No response

How were you moving?
- Heading straight
- Turning left
- Turning right
- I do not remember

Personal details

What is your year and month of birth?
- Select year and month
- No response

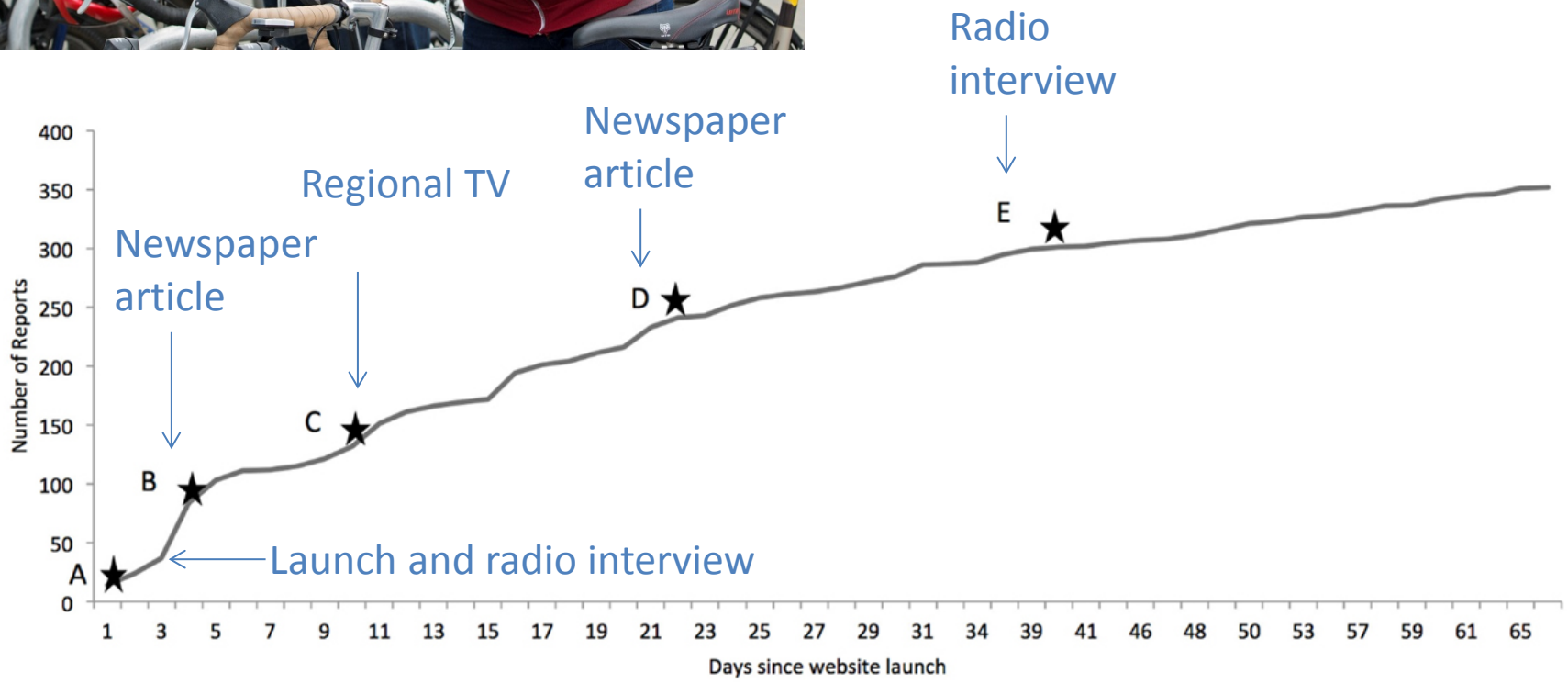
Please select your sex
- Male
- Female
- Other
- No response

Do you bike at least once a week?
- Yes
- No
- I do not know
- No response

Were you wearing a helmet?
- Yes
- No
- I do not know
- No response

Were you intoxicated?
- Yes
- No
- I do not know
- No response

Launch October 2014



Data so far…
812 incidents

- Crashes: 23%
- Near-Misses: 38%
- Hazards: 29%
- Thefts: 11%

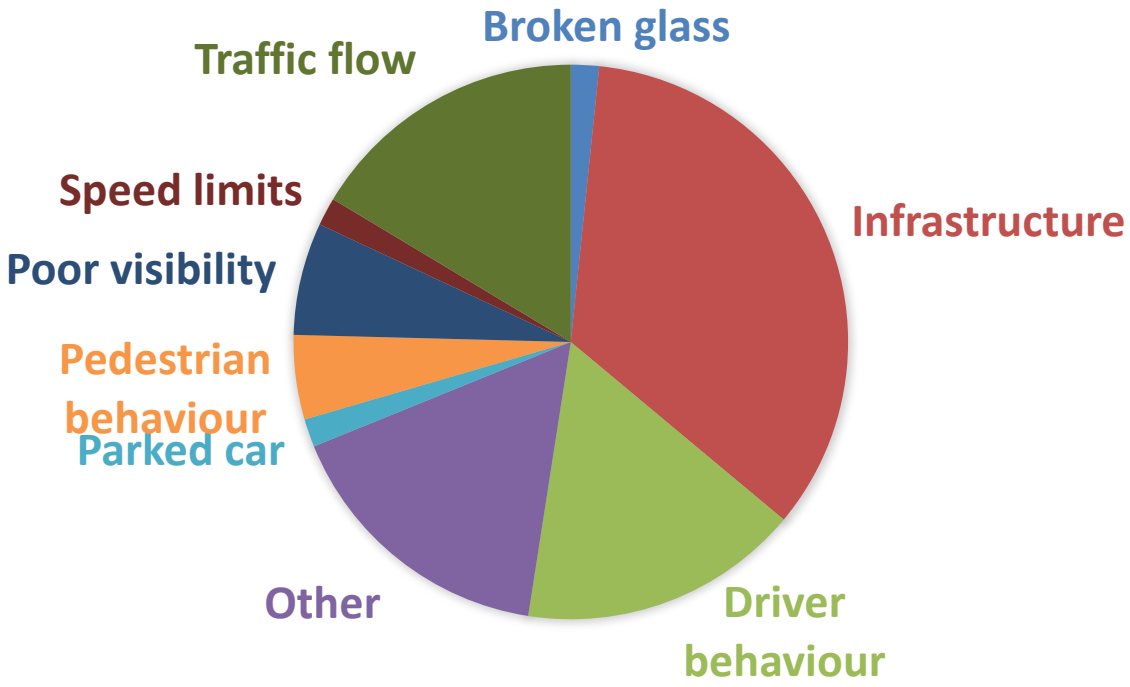
- 14 countries: Canada, US, Australia, UK, Germany, Costa Rica, Belgium, France, Denmark, New Zeland…

Data so far…
Crash and Near Miss

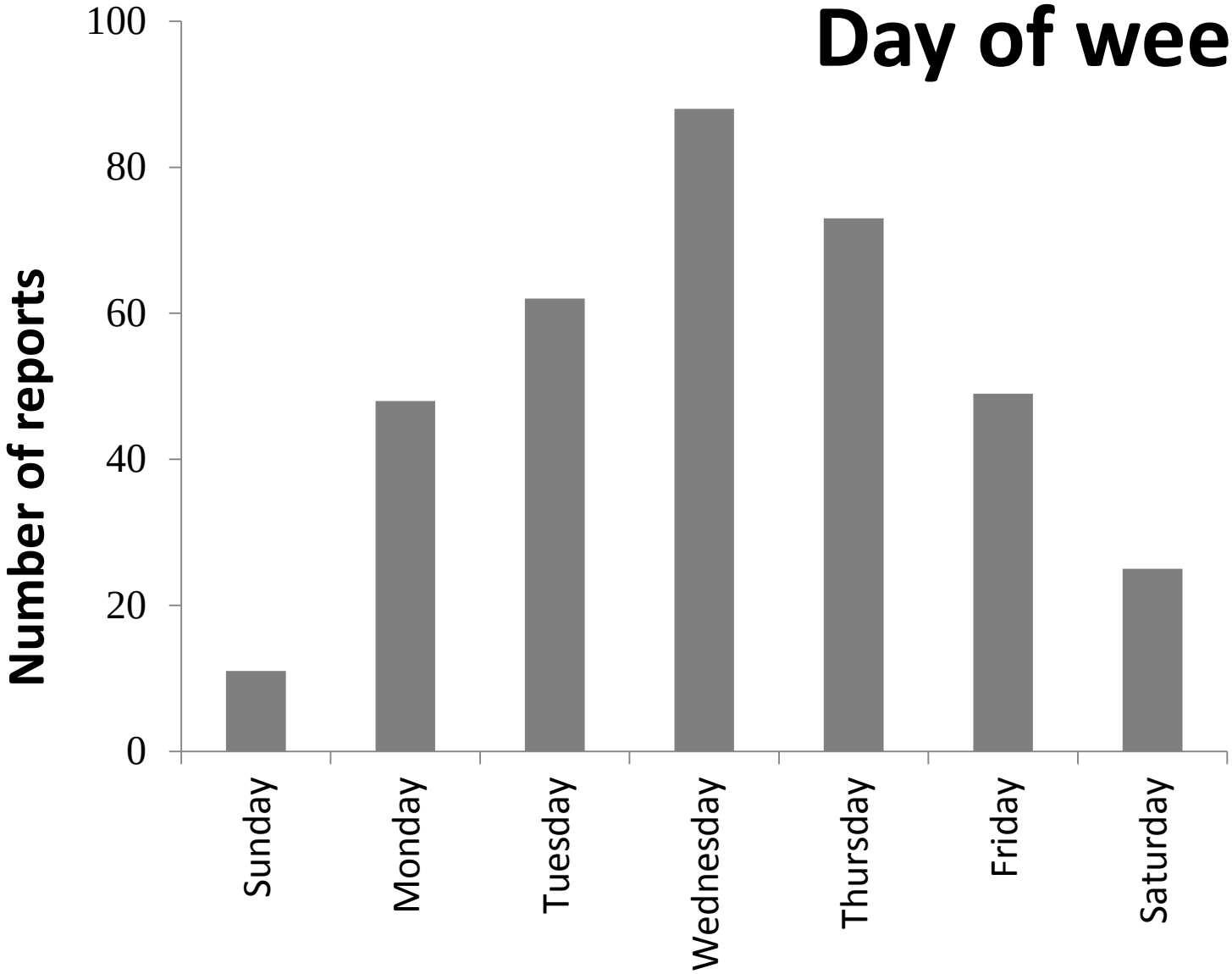
- 84.7% commuters/purpose specific
- 76.2% of incidents occurred in 2014
- 50.0% of data had all attributes filled in
  (+10% missed only 1 attribute)
- 17.2% female, 42.0% males, 40.8% didn’t say

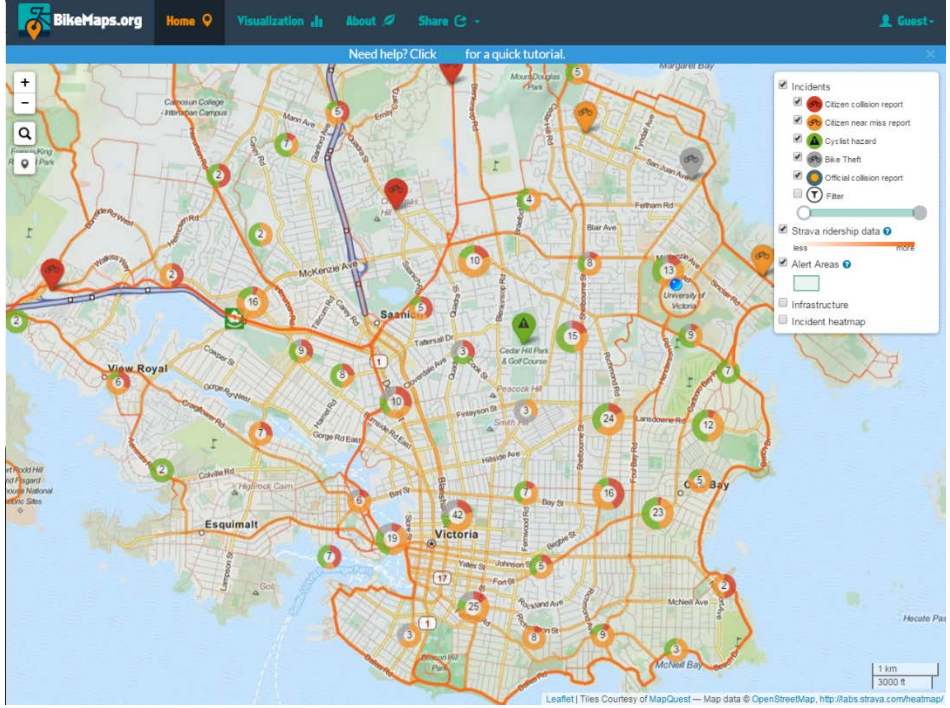
Data so far…
Hazards

82.5% from 2014



Data so far…
Day of week trends





CRD Data, first 6 months

- Crashes: 80
- Near-Miss: 179
- Hazards: 118
- Thefts: 30
- **Total: 407**

Year	ICBC Reports in the CRD
2009	119
2010	131
2011	131
2012	136
2013	140
Total	657

Research Applications

- Determinants of risk and safety
- Space-time patterns of risk hot spots
- Comparing traditional and citizen generated data
- Integration with rider data – Strava

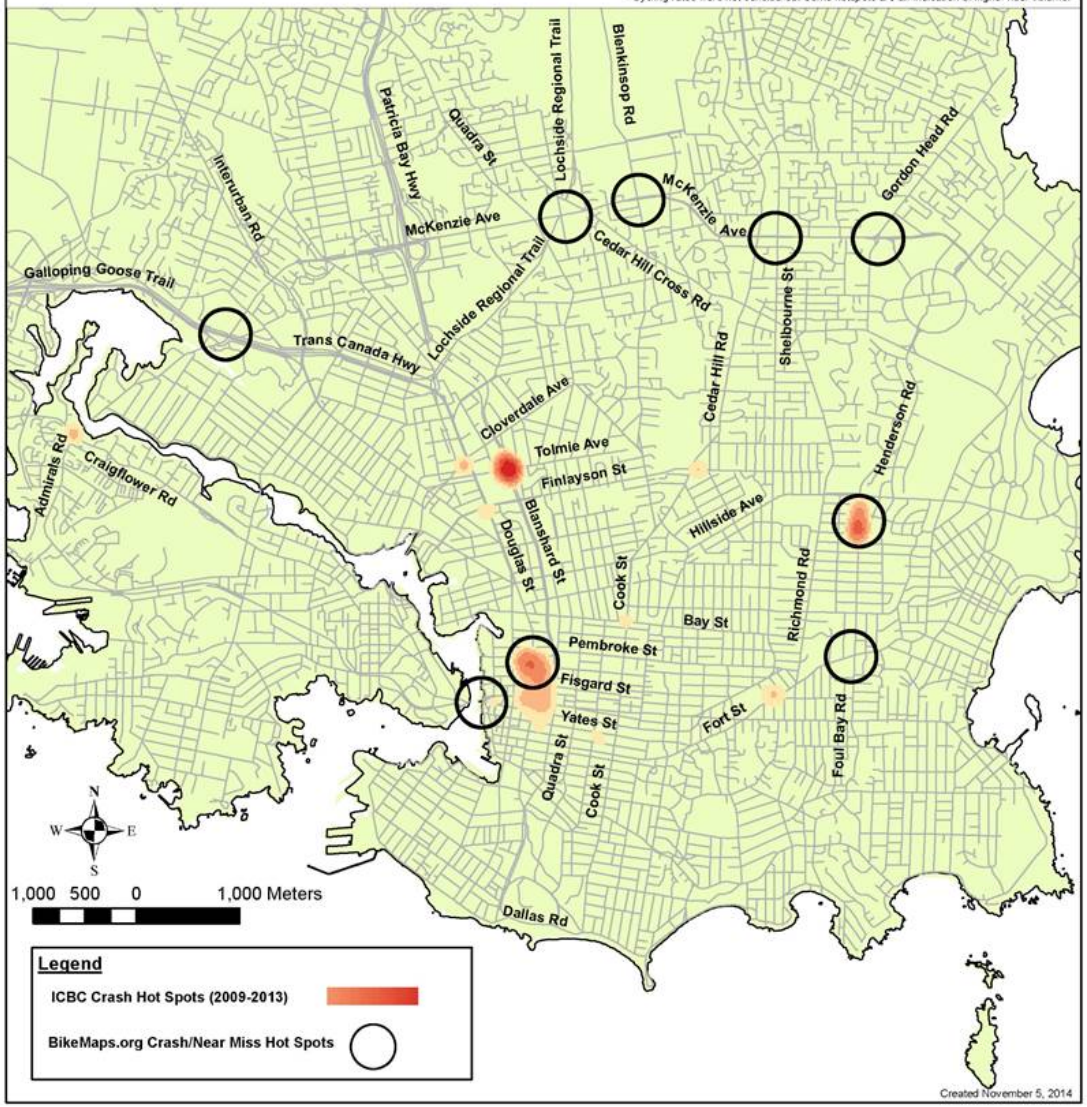
BikeMaps.org CRD Update Nov. 6, 2014

BikeMaps.org has been live for one month and citizens are highlighting trouble spots on heavily used cycling routes. 60% of mapped data are near misses. Phew! There is also lots of mapping in and around UVic - the headquarters of BikeMaps.org.

Key Areas highlighted on BikeMaps.org:
- Hill on Foul Bay Rd, south of Hillside
- McKenzie corridor (@ Gordon Head Rd, Shelbourne, Blenkinsop, Lochside Trail crossing,TCH/Admirals)
- Fort and Foul Bay Rd area
- Johnson Street Bridge

Thanks to all the BikeMaps.org contributors.
Let's keep mapping our way to safer cycling!

*Cycling rates were not considered. Some hotspots are an indication of higher rider volume.



Technology Developments

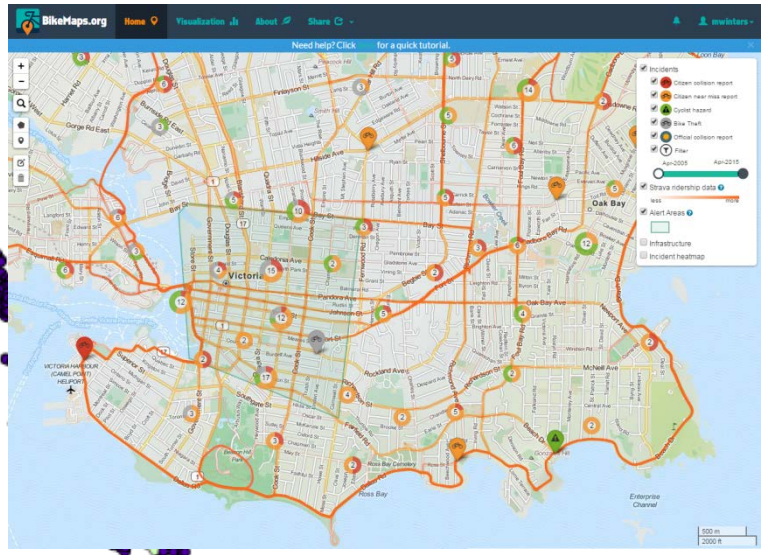
- Mobile App
- Improved hazard mapping
- Route data collection
- Graphic and real time alerts
- Route finding (safe routes)
- Open311 or equivalent

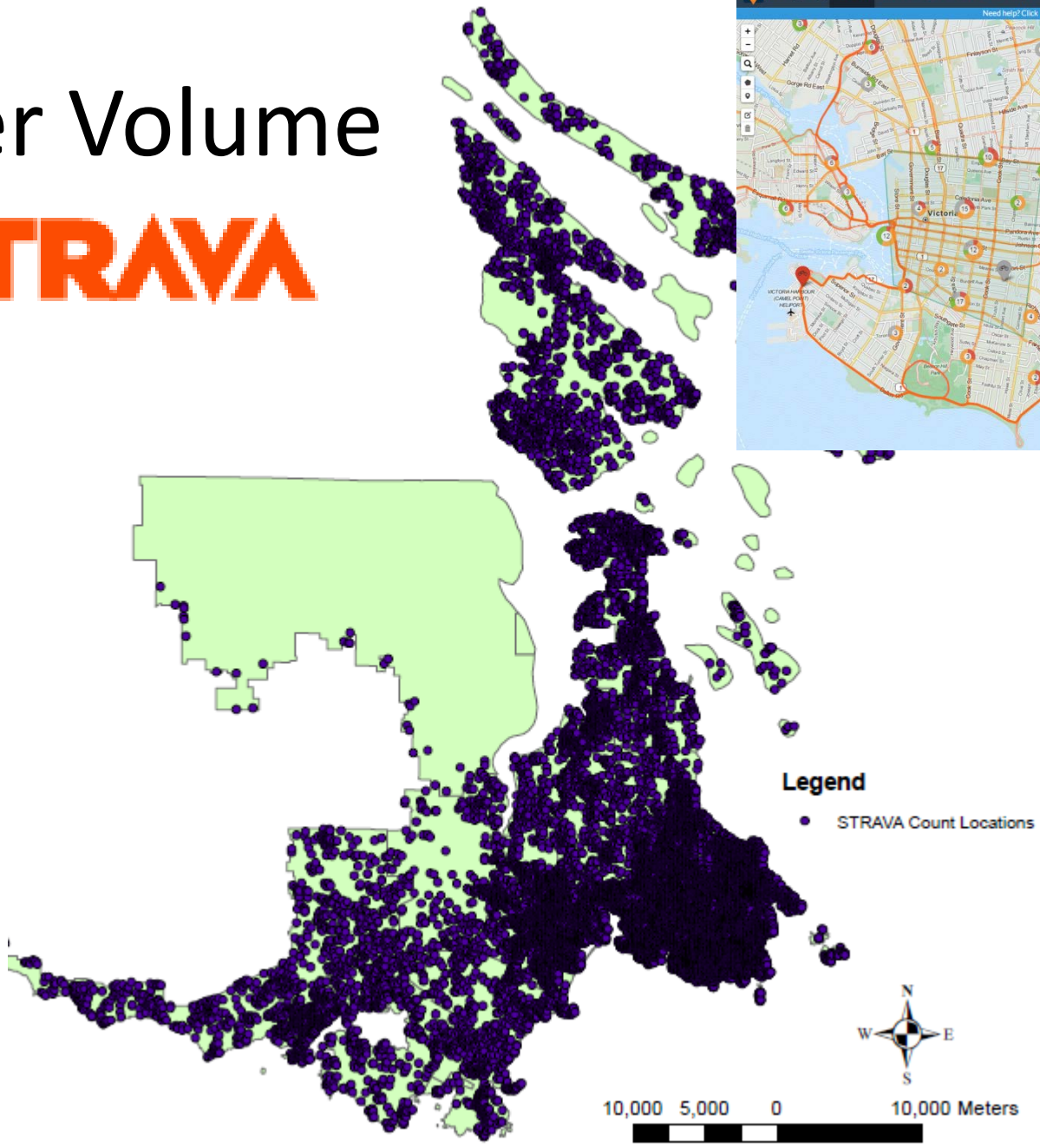
Contributions

- More complete cycling safety data – especially near miss data, comprising nearly 40% of reports
- Citizen engagement
- PedMaps – for pedestrian safety?

Rider Volume

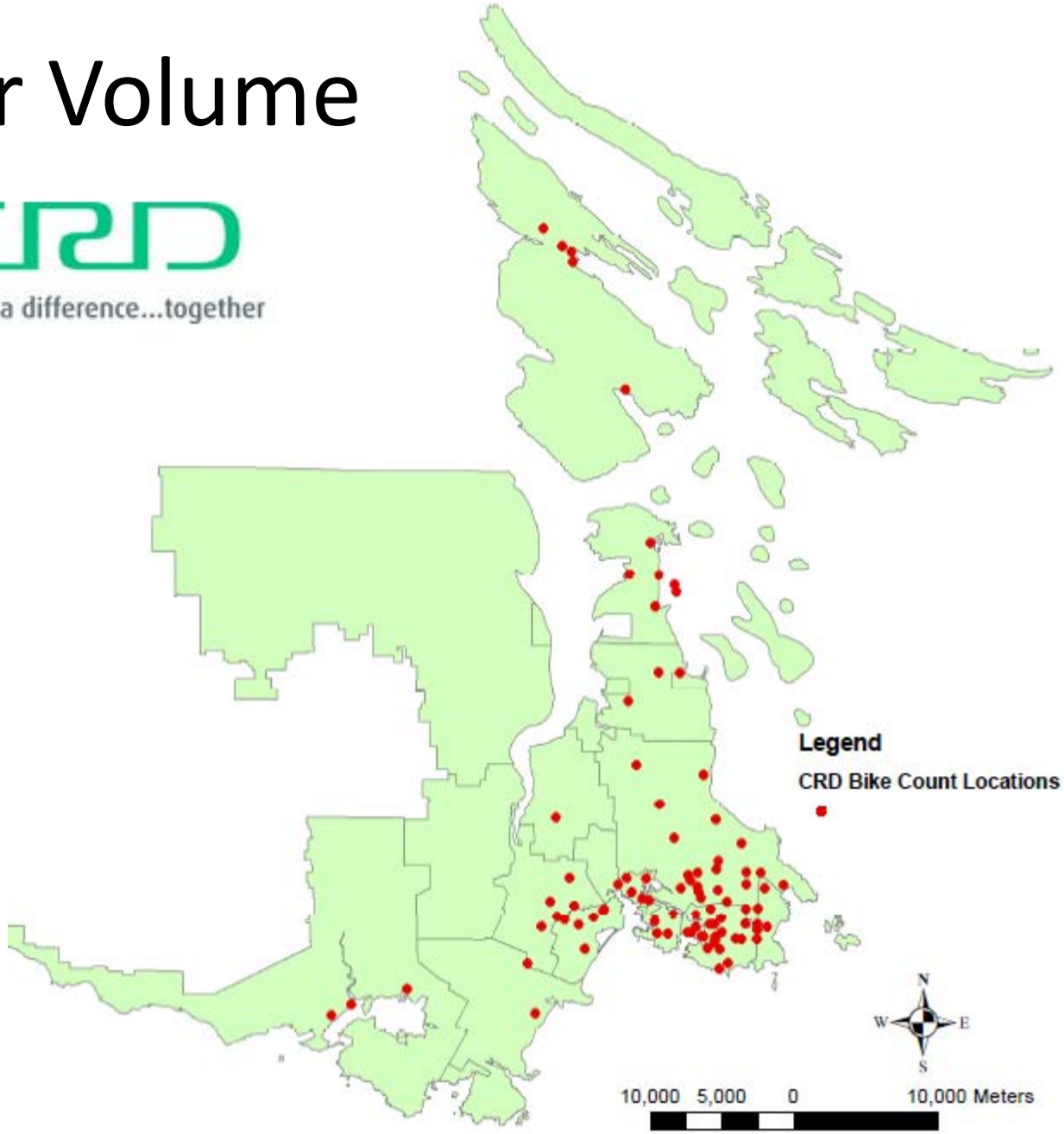
STRAVA





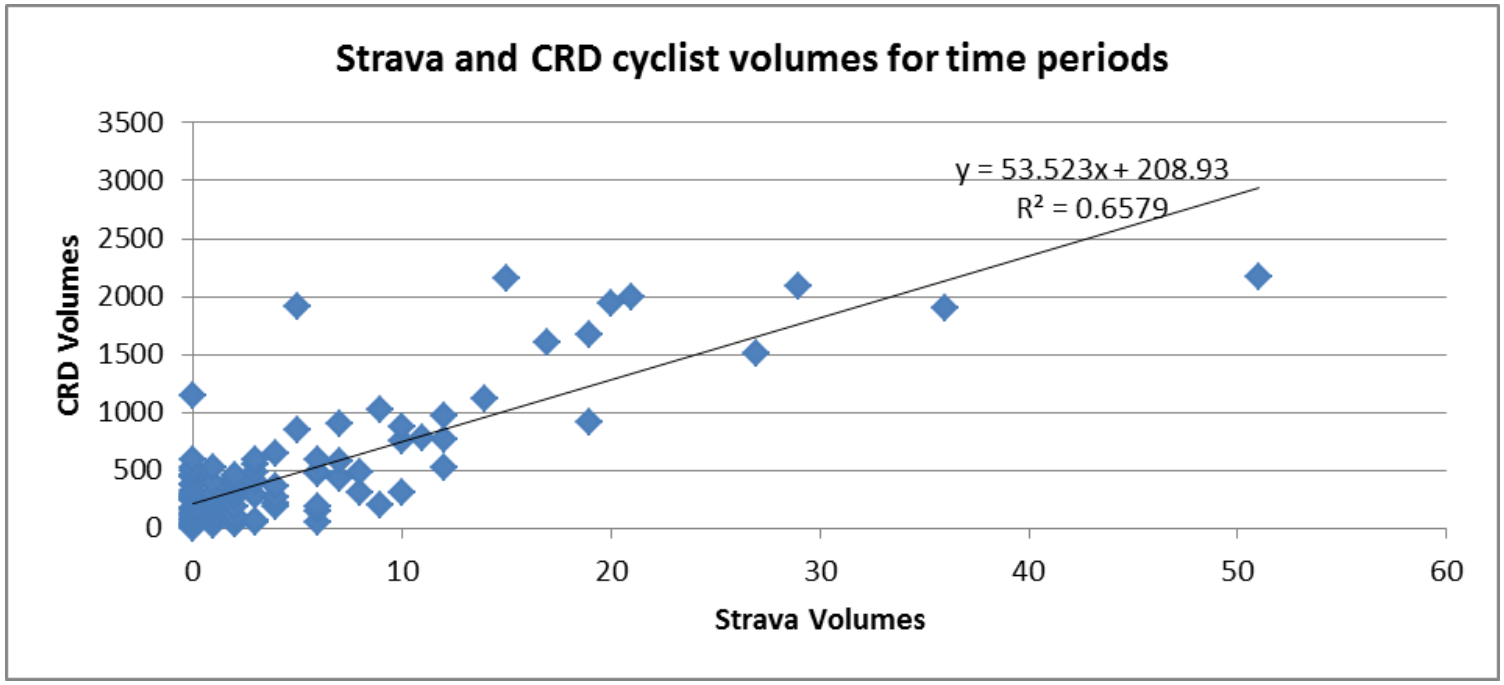
Rider Volume

Making a difference...together

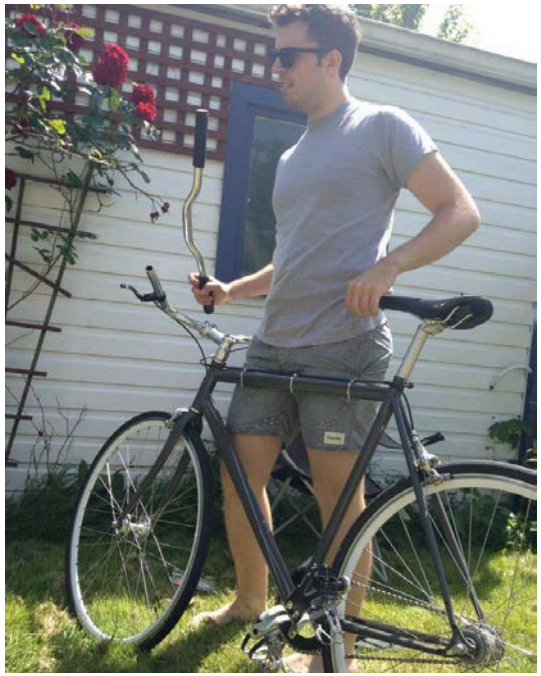


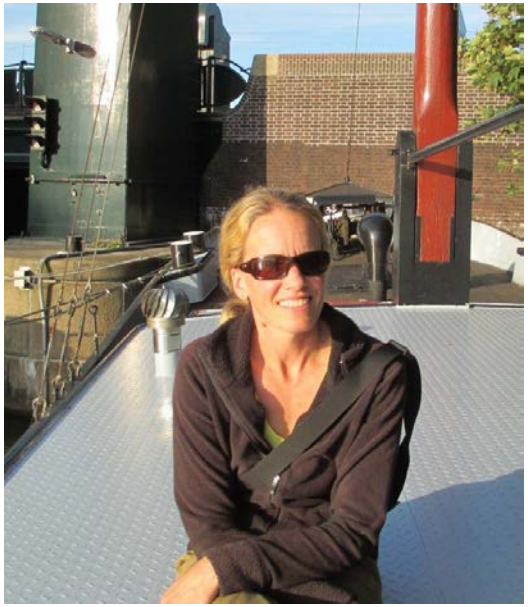
Rider Volume Results

- CRD volumes vs Strava volumes $r^2 = 0.6579$
- Clustering around zero due to many stations low CRD volumes and low Strava



BikeMaps.org





@BikeMaps

***Please be in touch for help with promotions in your city**

bunt & associates

Our focus is Transportation Planning and Engineering. Our reputation is everything.
Vancouver | Victoria | Calgary | Edmonton | *Celebrating* 20 *years in business*

STRAVA

sparlab
spatial pattern analysis and research

NSERC CRSNG

University of Victoria

BCAA CAA

CRD
Making a difference...together

SFU
SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

ACART

TIRF